MAY AN INCREASED FOCUS ON STUDENTS' PERSONAL DEVELOPMENT CONTRIBUTE TO INCREASED MOTIVATION, BETTER ACADEMIC PERFORMANCE AND TEAMWORK IN ENGINEERING PROGRAMS?

Marie Bernelo, Sofia Honsberg, Anette Järelöw

Jörgen Blennow, Lena Peterson

Area of Education EDIT-I
Chalmers University of Technology
Gothenburg, Sweden

ABSTRACT

Our hypothesis is that an increased focus on engineering students' personal development in the curricula will increase their motivation, academic performance and teamwork. With this starting point we have developed the EDIT model for personal development aimed at the engineering students in the 5-year EE, CE and SE programs at Chalmers University of Technology. The EDIT model comprises the topics and the process and timing of the delivery in the curricula at the bachelor level. It is based on behavior-scientific theories and on 40 years of experience in guiding engineering students at Chalmers. The fundamental concept for the model is that introspective knowledge gives extrovert ability. It comprises four topics: Motivation and learning, Teamwork, Leadership, Career and professional life, and a complementary reflection package. Based on motivational theory and pedagogical literature, we discuss why we have selected these topics and how they should be implemented in the curricula and syllabi to facilitate the development of the students. We argue that these topics should be placed in a context and at a time that makes them meaningful to the students. We give practical examples from the project test implementation and discuss practical issues that are likely to hinder the long-term success. In conclusion, we find that there is some evidence from our experiments that motivation and teamwork is improved. The possible effect on academic performance is so far very hard to assess.

KEYWORDS

Personal development, reflection, motivation, learning, teamwork, leadership, career planning, pass rates, generic skills

1. INTRODUCTION

In this paper we present initial results from a multi-year project that aims at increasing students' motivation, academic performance and teamwork through an increased focus on personal development in the Electrical, Computer and Software Engineering programs at Chalmers University of Technology (Chalmers for short) in Gothenburg Sweden. In this section we set the scene and explain why we undertook this project.

In Sweden and at Chalmers there are 3-year engineering programs and 5-year engineering and architecture programs. Since 2005, the 5-year engineering programs at Chalmers are organized as 3-year bachelor programs followed by 2-year master's programs, according to the Bologna model. The bachelor program in the 5-year engineering program is kept

separate from the 3-year engineering program, thus there are now two types of 3-year programs running in parallel. In this paper we are concerned with the 5-year programs in Electrical Engineering (E), Computer Engineering (D) and Software Engineering (IT) programs. These we call the EDIT programs for short.

Since around 2005, the 5-year EDIT, and also the 3-year ED programs, have suffered from a serious decline in the number of applicants which has resulted in a significant decrease in student volume in the programs, but also in less motivated students and a rather poor recruitment of female students and students from a non-academic background. This deficiency has in turn resulted in lower academic performance, measured as pass rates at course level as well as at the program level.

Due to the poor recruitment and decrease in academic performance a curriculum-reform study was initiated in 2008 by the Chalmers vice-president of education and continued in 2009 when the main task was to propose a totally new program structure and curricula where students would be admitted to **one** 3-year program (well actually two: one for E and one for DIT) which would result in both a 3-year engineering degree and, if succeeded by a 2-year master's program, a 5-year engineering degree [1-2]. One belief was that such a structure would increase recruitment because it would be easier to understand for prospective students as there would not be a 3-year and 5-year program with the same name to choose between. On the other hand, students in such a program would have to make important choices within the programs already in their second year. One important outcome of this study is the fundamental idea of placing the engineering student and her personal and professional development at the center of the program and considering the teaching and learning activities (courses, projects etc) as means to achieve this development. That is, with this student-centered perspective the personal and professional development is the backbone of the curriculum. Here, the ideas of constructive alignment [3] and CDIO [4] played a central role. Constructive alignment (CA) was conceived as a method to use at the course level (Biggs). Biggs argues that students construct meaning from what they learn and that the teacher is to design a course such that its intended learning outcomes (ILOs), student learning experiences, and assessment is aligned [3]. Related is also "backwards design" [5]. However, CA has later also been used at the program level [6] to align student learning experiences, learning sequences over an entire program to program learning outcomes. The alignment has several purposes: one is to make sure that the constructed meaning is the one the teacher intended, a second one is to make the student take responsibility for his / her own learning, a third is to make the student expect success upon completion. In this context of professional engineering programs, personal development is a program learning outcome in its own right, as well as a means to an end.

The idea of having only one common 3-year program per subject area was not realized, mainly due to faculty opposition. But the idea of placing the personal and professional development at the center of the curricula prevailed in the management of the 5-year EDIT programs. Thus, a more modest and long-term curriculum-reform project was initiated and run jointly by these three programs in 2010. In this paper we describe the results so far of this project.

Our hypothesis is that an increased focus on the students' personal development will contribute to increased motivation, better academic performance and teamwork in our engineering programs. We approach these issues from a behavioral-science perspective rather than from a pedagogical perspective. In this project we have consistently used a student-centered and experience-based perspective and we have taken advantage of the 40 years of experience that three of us have as student counselors. The research and development reported in this paper, has been conducted through literature reviews, participation in conferences, discussions with leadership consultants and interviews with

employers, students and teachers. During the project, different elements were tried out and evaluated in the current EDIT programs.

This rest of this paper is organized as follows: In section 2 we give a short background on personal development and motivation theories related to our work. In section 3 we present the EDIT model of personal development and in section 4 we place this model in a context. In the following section we present the experiences made from the implementations in 2010 and we conclude by a return to a discussion and conclusion related to the answer to the question posed in the title.

2. PERSONAL DEVELOPMENT AND MOTIVATION

Personal development and motivation are related due to both being about acting on explicit or implicit goals.

2.1 Personal development

According to Aubrey, personal development can be defined as “activities that improve self-knowledge and identity, develop talents and potential, build human capital and employability, enhance quality of life and contribute to the realization of dreams and aspirations” [7]. Personal development can also be viewed as being closely related to coaching, where coaching aims at unlocking a person's potential to maximize his performance. It facilitates his learning rather than teaches him [8]. Most coaching writers argue that the purpose of coaching is personal development, but one also finds the term personal development in related disciplines such as cognitive therapy, client-centered therapy and the Socratic dialectic [9]. Over time, many different theories about and approaches to personal development have been brought forward. The result of an internet search suggests that personal development is a term for all that a person may develop individually, i.e. everything that gives an individual more control over her life and her feelings, makes her feel better and build stronger relationships with people in her surroundings. The term personal development can refer to becoming more productive and efficient in work and to simultaneously manage to stay focused on what really counts in life. Personal development is considered important and necessary for good health. However, exactly what personal development means, each person has to decide for herself. It is the goals of the individual that determine what personal development is and it is also the individual who is the driving force in the development.

Lennéer Axelson and Thylefors argue that in your own internal dialogue an extensive self-knowledge emerges [10]. Also in the interpersonal dialogue, e.g. in the open and intimate conversation between people who know each other well, a comprehensive self-knowledge takes place. In this way you learn how you are perceived by others, both your strengths and your weaknesses, and you can use this feedback to change yourself if you want to. Knowledge in itself is a great asset since it inspires confidence and pre-understanding of who you are [10].

The socio-cultural perspective in pedagogy also emphasizes human communication as a means of learning and development. Säljö describes the social-cultural perspective and argues that humans develop through interaction with others and through sharing experiences with others [11]. By communicating what happens, the individual is involved in how its environment perceives and explains phenomena. Communication precedes internal meaning-making. Thus, one learns in the context of a particular culture and a particular societal community. The socio-cultural perspective identifies a channel (a form of human communication) through which learning and development takes place. “Communication is the link between the internal (thinking) and external (interaction)” [11].

2.2 Motivation

There are many motivation theories but they give no clear answer to the question "What creates action?" Early motivation psychology assumed that humans acted mostly driven by innate biological needs or by seeking rewards and avoiding punishment. Later, the ideas of a third driving force, a kind of internal motivation that creates satisfaction in managing and performing a task, have been established. Deci and Ryan developed what they call the self-determination theory (SDT). This theory claims that we have three innate psychological needs: competence, autonomy and relatedness. When these needs are met, we are motivated, productive and happy. Of the three needs the autonomy is the most important one [12]. Since the theory was first published, in 1985, almost a thousand research reports have reached to the same conclusion: Humans have an innate, internal driving force to be self-governing and to feel belonging to others. When that driving force is released you achieve more and live a richer life [13]. Pink draws the conclusion that genuine motivation is created through self-control, mastery and meaning [13]. Our interpretation of it is that humans, in order to do advanced things, need to decide how, in what way, when and with whom the task should be done. You have to be allowed to work on your own terms and feel partnership. Humans have an innate desire to develop and succeed in what they do. You want to perform better, experience engagement and be absorbed by the interest for the task, although the reward is absent. Internal motivation also arises when you feel that what you do is meaningful and when it is clear that the task will result in what you want and that you understand what use you will have of it.

Human needs are basically the same for all humans. However, depending on needs that have already been met, individual history and circumstances (i.e. childhood conditions, social and community context, values, etc.) the individual will be motivated by different things. Some are motivated by external factors: I have to pass the exam, otherwise I get no further financial aid; I want to get a job; I want a profession that guarantees a certain status; I want a high income; I want a certain affinity in the community. Others are motivated by internal factors such as the desire to develop and learn more, a genuine interest in certain things, etc. In personal development we want to support students in exploring their motivation. To manage a long and at times very hard education, we need to encourage the students to find their inner motivation, i.e. what makes them feel that studies and knowledge are joyful, that they have chosen both the topic of studies and to do the studies of their own volition and that the studies are meaningful for them.

What we want is to create an environment that facilitates the creation of this internal motivation rather than, as it often is today, that students are driven merely by external motivation factors. This we believe, we can achieve by designing the process, by emphasizing communication and relation and by working with the students' own goals. That is, by a focus on personal development.

3. THE EDIT MODEL OF PERSONAL DEVELOPMENT

We define personal development as having two dimensions: the inner dimension that is about self-knowledge and the outer dimension that is about social ability, figure 1.

An engineer with good self-knowledge has a higher ability to direct herself, adapt her behaviour, make well-considered decisions and in addition posses a higher degree of well-being. An engineer with good social skills is able to socialize in both private and professional contexts and is able to cooperate with both superiors and subordinates even though the personal chemistry is not very well matched.

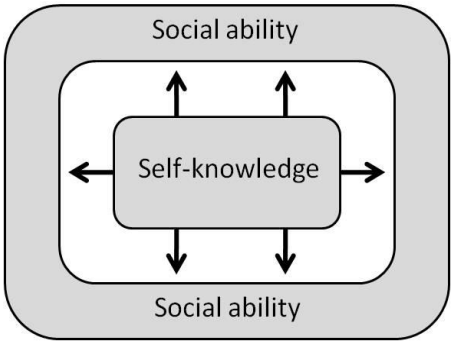

Figure 1. Personal development defined as having two dimensions: the self-knowledge in the inner dimension that leads to the social ability in the outer dimension.

3.1 Model contents

The first starting point when developing the model was the idea that an increased self-insight would lead to increased motivation, increased sense of responsibility, improved cooperation ability and an increased ability in making their own decisions.

Based on the ideas formulated by Lennéer Axelson and Thylefors, Luft and Ingham, Schutz, [8, 12, 13] and our own experiences from meeting students in counseling situations, we deduce that the more you know and learn about yourself the more competent you become, i.e., introspective knowledge gives extrovert ability. Thus, personal development consists of two dimensions; the inner one that deals with self-knowledge and the outer one that deals with social ability. A person having good self-knowledge has a higher ability to guide herself, is able to adapt her behavior in different situations, is able to make rational choices, is able to make well-thought-out decisions and, in addition, has a higher degree of well-being. A person having a high social ability is able to socialize in different contexts privately as well as professionally and is able to cooperate with all, subordinates as well as superiors, even if the personal chemistry is not matching. That person also understands her own and others reactions and behaviors better and is able to act based on this knowledge.

A second starting point is that it is important for human beings to feel a sense of belonging, to feel competence, to feel liked and that self-perception and self-respect is of vital importance for personal and professional efficiency [15]. This implies that it is important for our students to feel that they fit in, to feel that they have made the right choice, to feel that they can handle their studies and the study pace and that they feel a sense of community. It is therefore important that these aspects are addressed in order to facilitate increased pass rates. These statements are supported by the annual survey on youth attitudes conducted by *Ungdomsbarometern* [16] which shows that young people are concerned that the studies will affect the personal economy negatively, that they will make the wrong choice of education, that they have low motivation, that the study pace is high and that they will not pass the exams.

After literature studies and work on formalizing the informal knowledge from our extensive experience, we settled on a relatively narrow approach to personal development and many possible topics were left out. When discussing personal development with teachers, students and industry representatives we have found that they also mention and request “professional development”. This term we take to mean professional skills. These are also important, but mainly excluded in our model, since we focus on topics that we believe are related to our end goals of better motivation and academic performance.

We propose a model for personal development in the curriculum enabling the students to acquire knowledge, methods, tools and abilities within four areas: motivation and learning; teamwork; leadership and career and professional life, figure 2. In addition to these four topics, a reflection package is added which helps the student identify and reflect on her development aiming at achieving increased self-insight. In our opinion, no self-knowledge will be gained without reflection so this is a crucial element in personal development.

In the **Motivation and learning** section it is important to get students to feel both motivated by affiliation and expertise. According to the Qualifications ordinance a graduating engineer should "demonstrate the ability to identify the need for further knowledge and undertake ongoing development of his or her skills". This goal is about developing effective methods for learning but also about reflecting on the limits of one's ability and to understand when upgrading of the competence is required.

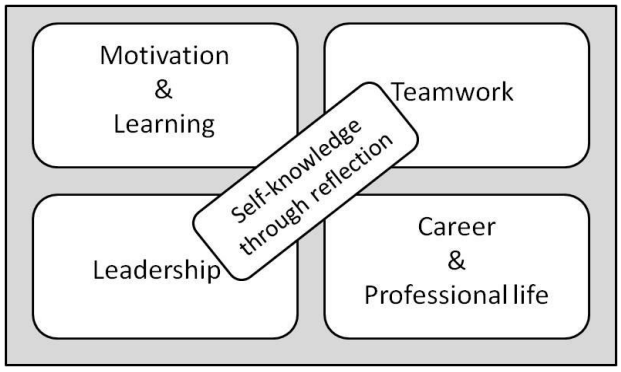

Figure 2. The EDIT personal-development model based on four topics and a complementary reflection package.

By offering early contacts with professional engineers and by working with and clarifying the student's own objectives underlying her choice of education, and by making a plan for achieving these goals, we will create accountability, drive and motivation and a sense of having made the right choice and a desire to stay the course. By adding study support activities such as Supplemental Instruction (SI) [17], student coaches and study skills sessions with a focus on training and reflection, we can support the students in feeling an increase in competence and in decreasing their fear that they will not cope with their studies.

In the **Teamwork** section the underlying ideas are that everyone should experience belonging, competence, and camaraderie. The Qualifications ordinance states that an engineer on completion of degree "should demonstrate the capacity for teamwork and collaboration with various constellations". Therefore, there is already quite a bit of group and teamwork in the current EDIT curricula, but there is still a lack of knowledge and reflection related to this area. This lack of explicit group competences sometimes leads to unsolvable conflicts, wrecked projects or delayed project deliveries. As a result students may feel excluded and supervisors powerless. By providing increased knowledge, reflection and understanding of group processes, team roles, values and conflict management and on how to use the group as a resource, we will create better opportunities for delivering project results on time with high quality. In addition, we will contribute to the students feeling a sense of belonging and to conflicts being prevented; thus, freeing up valuable supervision time.

By increasing the inner knowledge, i.e. increasing the knowledge of what is important for me, how I cooperate, what roles I take, what is hindering me, I will increase my outer ability to act well in a group. This leads to higher self-esteem, better collaboration ability and fewer unsolvable conflicts.

In the **Leadership** section the idea is to further nurture and develop the reflection the student made about herself and her way of being and reacting. Good leadership is basically about learning to lead yourself, knowing who you are, being clear, having the necessary courage and integrity, knowing your values and making decisions based on faith and trust instead of using fear as a driver. Our students will also be given a better position to become leaders if they have an opportunity to develop their personal leadership. Exercising leadership in different ways, for example by being the leader of a student work group (e.g. Supplemental instruction) or being a mentor for a group of newly admitted students, enables the student to try out leadership theories in practice which increase her self-knowledge through reflection and feedback. To this real-world experience theories of leadership, humanity, communication, conflict management and feedback are added.

The idea behind the **Career & professional life** section is that the students will be motivated and feel that they have made the correct choice by having a better picture what the future entails. A mentor program and a career-counseling course with an increased reflection of who I am, what I know and what I want, together with increased involvement of professional engineers in the first year of study are pieces that will help the student to feel that they have made the right choice and that they fit in. An increased insight into the professional life as an engineer and an increased self-awareness also helps students to deal with the various choices that the students have to make during their education.

We believe that "introspective knowledge gives extrovert ability" and that the increased self-awareness resulting from reflection and increased focus on personal development results in increased motivation, higher academic performance and better cooperation ability. Therefore, a **self-insight through reflection** package that helps students to identify and reflect on their development is introduced in our model. For the reflection to happen, students need to devote time to the process, get reflective questions that raise awareness about themselves and receive feedback on their behavior. It is through this increased self-knowledge that the opportunity is created to turn passive knowledge into valuable experiences that provide insight and power and motivation for change.

Pedagogical, as well as psychological, literature emphasizes the importance of reflection, dialog and feedback for personal development and learning. Also, from our own experiences in counseling and coaching we know that people develop and gain insights when responding to reflective questions that broaden and deepen the perspective and that offer the opportunity to try new behaviors. Therefore, a cornerstone of this model is that personal development takes place and is accelerated through dialog and reflection.

3.2 Curriculum Implementation

In our proposed curricula the focus shifts over time among these four topics, from motivation and learning in the beginning of the programs towards professional life and career at the end of the programs. Thus, thinking in terms of progression is important. An outline of a possible sequence for a bachelor program is illustrated in figure 3. When the sequence model shown in figure 3 is developed in more detail, different topics can be identified as indicated in figure 4.

Some examples of learning outcomes of the proposed personal-development package at the curriculum level could be that after completion of program the student should be able to:

- Set, understand and use her own goals, motivation and driving forces
- Use her self-knowledge for strengthening her external ability
- Work together in teams and understand how a group develops
- Reflect on professional roles, professional life and career planning

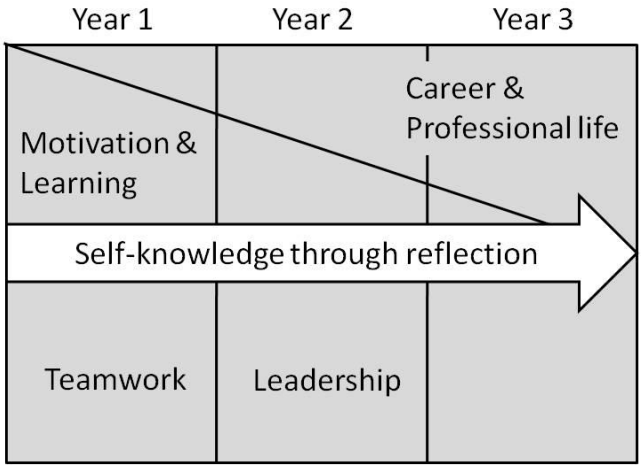

Figure 3. Major elements of EDIT personal-development model shown as a possible sequence for the bachelor part of a 5-year engineering program.

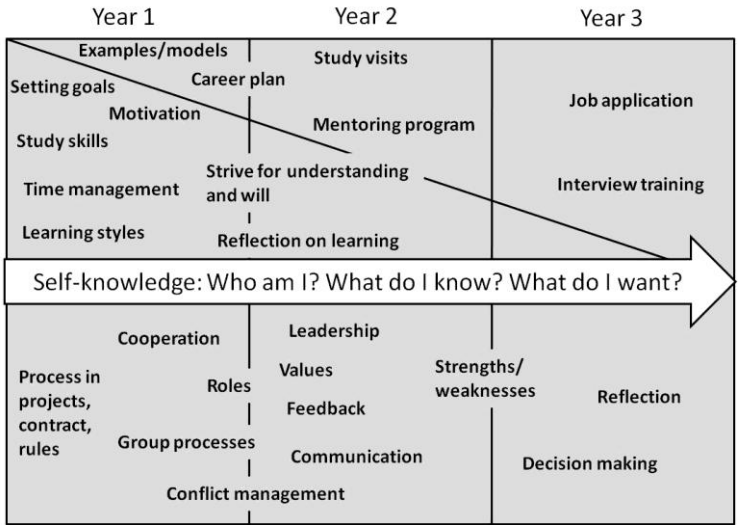

Figure 4. Elements of EDIT personal-development model laid out in a possible learning sequence for the bachelor part of a 5-year engineering program.

Based on the on theories of Lennéer Axelson, Thylefors and Säljö we argue that the learning should take place in interaction with fellow students and that self-reflection should be used as the learning method [8, 9]. We believe that personal development is a subject where learning by doing is a must and it is therefore obvious that constructive alignment should be used in the implementation of personal development. An example of personal development elements in a program curriculum is illustrated in Table 1.

Course-level Implementation

As stated above we believe that personal-development elements must be integrated in the program curriculum at times and in contexts that make them meaningful to the students. Still there are some options on how to do this. One way is to add elements into some **existing courses** and let the present teachers teach them, possibly supported by some consultant input. Another way is to create a **separate course** that runs over three years dealing with engineering skills which are assessed separately from other courses but which could be linked to parallel courses whenever possible. A third way is to introduce personal

development by adding **reflective elements in every course**. All courses will then have an ongoing parallel track containing reflective elements of personal development, where the student learns about herself. This parallel track does not alter course content but adds a new dimension.

In an ideal world, we believe the proposal involving reflective elements in each course is the one that would achieve the best results, since it would involve all teachers and have an impact not only on the individual level but also at the organizational level. However, the project steering group has assessed this proposal as impassable in the present situation.

Table 1
Example of personal development elements in a program curriculum

	Year 1	**Year 2**	**Year 3**
Program and/or group level	• Purpose and structure of educational program • Study skills • Goals / motivation • Group processes • Academic year wrap-up	• Information – program tracks • Personal leadership • Attitude / values • Academic year wrap-up	• Information – master programs • Culture clashes / conflict resolutions • CV/ personal letter • Academic year wrap-up
Individual level	• Learning style – what study strategy suits me? • Which role do I take in the group? • End-of-academic-year reflection	• Which direction for me? • Action plan • End-of-academic-year reflection	• Ethics / morals • Write my CV / personal letter • End-of-academic-year reflection
Job market	• Inspiration lectures • Alumni gathering – round-table discussions	• Study visits / interviews with alumni	• Mentors

The project's reference group has emphasized the importance of creating a system that is sustainable and independent of individual enthusiasts. In this respect, a separate course could be preferable, instead of integrating elements into too many courses, taught by teachers with a special interest in the issues. The reference group has also highlighted the risks of having too many integrated elements since it believes that this smearing out may increase the risk of personal development being regarded as less important.

We believe that there are advantages and disadvantages with the two remaining solutions. If the choice falls on integration, it is likely that the difficulties will be substantial to achieve the common understanding and starting point that are necessary for successful integration. If the choice falls on personal development as its own course, it must be designed so that it runs through the curriculum with small elements at several occasions. Personal development needs a longer time cycle to work. Such a course is extremely difficult to manage in practice.

Each program needs to find its appropriate mix of integration and their own course, since a successful implementation also depends on the availability of suitable, interested teachers and of other teachers' feedback on the ideas and that heads of program assess the feasibility of implementing the changes. A feasible solution would be to integrate main elements of personal development into a few courses with project or group-work elements where they would have a natural connection to professional engineering skills. In addition, optional elements could be placed outside of courses, e.g. inspiration lectures, alumni gatherings, mentors and end-of-the-year reflections. Regardless of the implementation model chosen it

will require an integration manager who has the responsibility for personal-development learning sequence within the program curriculum.

Who will do the teaching?

Another important implementation issue is who will teach elements of personal development. Should it be the current faculty, experts in personal development or are there other options?

The reference group of this project suggests that personal-development elements should be taught by persons with expertise in personal development and not by the engineering faculty. This is because the persons responsible for these elements must have knowledge about the development of this field. In this project period the student counselors who worked in this project have also taught these elements. The proposed content of personal development lies, with respect to subject and competence, close to the competence area of student counselors since at Chalmers they often have a behavioral-science background. A new more proactive, team-oriented and educational role for student counselors may emerge as a result of this project. However, all student counselors do not have the appropriate competence profile and will not feel comfortable working this way. Chalmers is currently implementing a new organizational structure in which counselors are centralized, which might bring greater opportunities for differentiated roles. However, since personal-development elements probably will be integrated into existing courses a close cooperation with faculty is also necessary why an organizational structure closer to the faculty enabling this collaboration and interaction may be desirable.

4. THE EDIT MODEL IN CONTEXT

Both in the context of Chalmers Vision, Goals and Strategies [18], the Swedish Qualifications Ordinance [19] and the CDIO syllabus [4] the motivation for the introduction of personal development elements, as defined in the EDIT model, is strong.

The Qualifications Ordinance [19] for the five-year M.Sc. degree (*civilingenjörsexamen*) stipulates that upon completion the student should be able to

- demonstrate the ability to create, analyze and critically evaluate various technological solutions
- demonstrate the capacity for teamwork and collaboration with various constellations
- demonstrate the ability to identify the need for further knowledge and undertake ongoing development of his or her skills

Thus, from a program-outcome perspective, there is support for the introduction of educational elements covering motivation and learning as well as group dynamics and leadership.

The Bologna process has three overall objectives, one of which is to promote graduate employability [20]. To graduate engineers who are better prepared for today's professional life, should therefore be a good reason for introducing new elements addressing career and professional life in education.

Also, the CDIO syllabus provides support for many different types of engineering skills topics such as

- 2.4.5. Awareness of One's Personal Knowledge, Skills, and Attitudes
- 2.5.1. Professional Ethics, Integrity, Responsibility and Accountability
- 2.5.2. Professional Behavior

- 2.5.3. Proactively Planning for One's Career
- 3.1.1. Forming Effective Teams
- 3.1.2. Team Operation
- 3.1.3. Team Growth and Evolution
- 3.1.4. Leadership

all of which are within the framework of the EDIT model of personal development.

Also the Chalmers Vision, Goals and Strategies 2008-2015, supports personal development: “Chalmers’ educational programs focus on the individual’s development with supervision, problem-solving, industrial and research contact, sustainable development and reality-based leadership.”, [18].

Moreover, personal development, according to our definition, fits very well within the ideas of constructive alignment as self-awareness and personal development is achieved in active forms of teaching enabling reflection, that is student-centered learning [3].

After a short survey of engineering program curricula within Chalmers and other Swedish technical universities, we have not been able to find any course or identified learning sequence having content and process according to our definition of personal development. Nor have we have found anyone taking the overall approach to personal development that we have chosen to do. However, elements of what we define as personal development can be found in courses or as other optional elements offered elsewhere. These can be found in courses having titles such as: Appreciated leadership [21]; Work organization [22]; Communication and professional development [23]; Dialogue, coaching and personal development [24] and Qualifications’ portfolio [25]. Our reflection, after having studied these and other courses, is that it seems difficult to get courses of this kind to work as intended and that they remarkably often seems to be closed down or cancelled. Why then do we think that we should be able to get it to work at Chalmers? First of all we think that the time now has come for personal development and all the Heads of the EDIT programs are positive to these ideas. Then, students and many (but not all) teachers realize the needs and are positive, maybe due to the influences from the CDIO syllabus and the ideas of constructive alignment. Also external motivators such as the emphasis on professional skills in the Swedish Qualifications Ordinance and requests from employers may play an important role.

5. EXPERIENCES FROM THE EDIT-MODEL IMPLEMENTATION

During the project period, we have tested several elements of personal development. These elements have mainly been related to motivation & learning, teamwork and career & professional life and have been taught by the student counselors involved in this project (the three first authors). Table 2 gives an overview of what has been done.

5.1 How to Set Goals

In the beginning of the fall semester an introductory lecture was offered to new students aiming at introducing them to the concepts of setting goals, motivation and taking responsibility and to start a process that clarifies the student’s own responsibility. Attendance was not compulsory, but almost all students participated, possibly explained by the fact that presence usually is high in the beginning of the fall semester. No formal evaluation was done, but an oral evaluation showed that the students appreciated the lecture. For our side, it was an attempt to provide inspiration early and make it clear that students need a goal and a willingness to take personal responsibility for their goals and their future. Many students find

it difficult to set goals and the lecture gave an initial platform for continued work on goals and accountability.

5.2 Training in Setting Goals and Making Plans

Later during the fall, we held group discussions with the new students. The purpose of these discussions was to raise the students' awareness on how to set their own goals, make action plans to achieve their goals and to start the thinking processes on their own driving forces and responsibilities. No formal evaluation was performed but an oral evaluation showed that also in this case the appreciated the lecture. We noticed during counseling talks that more students than previous years had the need to discuss if they have chosen the right education and if they have sufficient motivation and incentive to study. From our point of view, it is positive that these thoughts arise early in the education when the student has not invested as much as energy, time and money in an education that may not suit him.

Table 2
An overview of elements of personal development that have been tested during 2010 in the Electrical, Computer and Software Engineering programs.

	Lecture	Workshop	Group disc.	Other	EE program	CE program	SE program	Integrated	Elective	Evaluation comments
How to set goals	X				X	X	X		X	Has not been formally evaluated. An oral evaluation shows that the lectures were appreciated.
Training in setting goals and making plans			X			X	X		X	Has not been evaluated. An oral evaluation shows that the elements were appreciated.
Study skills		X				X	X		X	Students appreciate exercises, inspiration and exchange of experiences during the workshop.
Introducing group dynamics	X				X		X	X		SE students requested also conflict management elements. EE students said that the content was relevant and of appropriate extent.
Exercises and reflection on teamwork and group dynamics		X			X			X		45 % of respondents considered exercises and lectures to some, large or very large extent contributed to improving the cooperation in the group.
GET SET™ Belbin's group roll test				X	X			X		Has not been evaluated.
Mentoring program				X	X	X	X		X	All participants express satisfaction. Students have established an important industrial contact and have become more self-confident on what they want and where they are heading.
Career planning course				X			X	X		Most students appreciate the course very much and believe that it is useful for them.

5.3 Study Skills

For the last 5-10 years, two lectures on study skills, given by an external expert, have been offered to the new students. Evaluations from previous years show that the students appreciate the lectures, but they are not inspired enough to act and really change their own study habits or behaviors. This year, we added two workshops as a complement. In these workshops, students make inventories of their own study habits and test new ideas to create their own active study strategies and methods based on ideas provided in the lectures. An evaluation of the workshops shows that the participating students appreciated the exercises, the inspiration and the sharing of experiences. According to the students, the workshops give results and act as an eye-opener to what you do and do not do in reality. As an improvement of the workshops the students suggest more sessions and further discussions among themselves.

5.4 Introduction to Group Dynamics

To introduce group dynamics, we have conducted lectures in the first and second years of the Electrical engineering program and in the first year of the Software engineering program. The objective has been to provide students with knowledge of the process of a project, knowledge of group development and to provide some practical tools for effective cooperation. Course evaluations show that software-engineering students want more group dynamics where feedback and conflict management are included. First-year electrical-engineering students perceived lectures and exercises as relevant, interesting and as being of appropriate extent. Second-year electrical-engineering students appreciate the lecture dealing with teamwork and said that it contributed to an increased enthusiasm in the beginning of the course.

5.5 Workshops in Group Dynamics

Also, in the first-year project course, the electrical-engineering students have been offered workshops on group dynamics on two occasions. In these workshops students have reflected on and discussed how their project group functioned. They have also participated in various exercises aimed at strengthening them as group members and have received feedback from their project-group members aimed at increasing their self-knowledge. The course evaluation showed that the lectures and exercises on group dynamics are perceived as moderately comprehensive, relevant and interesting. Even though 55 % of the students answered that these elements only to a small extent contributed to their group working well, from the comments in the evaluation we conclude that most of the students thought that their own group worked well. Of the responding students 34 % answered that group dynamic elements to some extent contributed to the group working well, while 6 % said it contributed to a great extent and 3 % said these elements did not contribute very much. One problem was that those students who needed these exercises the most did not attend, which rendered some exercises less meaningful, because the most affected groups did not get receive much instructor-led collaborative discussions.

5.6 Team Role Test

Students in the Master program in Integrated Electronic System Design have, in connection with a project course, been offered to participate in the commercial GET SET™ Team Role Test by Belbin [24, 25]. The test is based on Meredith Belbin's research on the nine team roles in successful teams [24, 25]. The test contains a number of questions that both the student and a number of persons that student has chosen herself should answer. The test report obtained includes results that both related to the individual and the project group of which the student is a member. The aim of the study is to provide greater self-awareness and to provide a picture of the strengths and weaknesses of the project group. In principle, all

students participated in the test, but all did not want to participate in the evaluation of it. We also performed the test ourselves within this personal development project and our opinion is that you can have good use of it both as an individual as member of a group team. The test results were strikingly positive in nature and had a focus on strengths rather than weaknesses.

5.7 Career course

In the project period we have also led the career course in the Software engineering program. Experience from the course show the importance of having exercises and questions that make the students reflect on themselves and where they are heading. Furthermore, for us, leading the course, it became clear that it is not easy to teach a course developed in detail by another teacher. Our conclusion from this experience is that the details of a course must be tweaked by the teachers and team leader who are to lead the course. The evaluation of the course show that it is much appreciated and that most students feel that their self-awareness has increased and that they have become clearer about what they want. A few answer that they do not appreciate the course (which is mandatory). Most students believe that they will benefit from this course.

5.8 Mentoring Program

Jointly with *Svenska Elektro- och Dataingenjörers Riksförening (SER),* we have also started up MEDIT, the mentoring program for fourth-year students in the EDIT programs. During the year, 23 students have each had a mentor from industry. One objective of the mentoring program is that it will contribute both to the students' personal and professional development. The program evaluation shows that both students and mentors are very satisfied with the mentoring program. For the students the program has led to an important contact with industry and that it has become clearer with what they want and where they are going.

5.9 Learning Outcomes

In our project we have aimed at formulating and introducing learning outcomes for personal development in courses where these elements are to be integrated.

An example from the EE program is the first-semester project-based introductory course “Technical communication” where learning outcomes related to group dynamics have been introduced in the syllabus for the academic year 2011/2012. After completion of the course the student should be able to

- Identify and apply methods for effectively working in a group
- Develop routines for continuously reflecting over the project work
- Work in a group and take responsibility for the project's completion
- Work with both the project's contents and process
- Create and use group norms
- Relate to personal values and how these affect the teamwork.
- Identify and apply methods for effectively working in a group

Thus, we are now clear in that one of the main objectives for the course is to practice teamwork, something that was previously unclear for both students and teacher, when most of the attention was paid to the content rather than to the process. Also, the learning outcomes of the course “Communication and professional development” in the SE program have been re-worked. There are on-going discussions in the CE program on introducing learning outcomes related to personal development into the course “Sustainable use of resources”.

So far, we have focused on introducing learning outcomes related to personal development in first-year courses, but our intention is to continue with courses in later years. Thus, the end result will be a learning sequence.

6. DISCUSSION

In conclusion, our experiences from our test in introducing elements of personal development, is that these elements generally are appreciated by the students. However, we have also evoked processes in the minds of some students that we must be prepared to take care of individually. We argue that it is important that students process these questions and get clarity in their motivation early in their education. It is worse if these doubts come later when they might have lagged behind in their studies.

An essential but difficult issue to address is how to assess the effect of introduced personal development elements. Key figures that could possibly be used as indicators, and which are measured annually, are pass rates on course level and the average number of credits scored per student after one year. However, these numbers vary over the years depending on external factors such as the admitted students' high-school GPA making the comparison of successive cohorts in the same program questionable. Comparison between programs the same year is even more fraught with problems since there are many additional factors that vary. Therefore, we suggest the use of qualitative approaches, for example one could follow the students' development through structured interviews and through reflective discussions either individually or in groups. An in-depth interview could be performed as an exit talk upon completion of the bachelor level. Possibly the attention paid to the students in this approach in itself will improve the perception of the students such that they feel more motivated and put a greater effort in the studies.

When we have tested group dynamics in the Electrical engineering program, we have noted that students are more satisfied with the cooperation in their project groups and they have reached further than usual at this stage in group development. In addition, the group members are in better agreement about the goals of the projects than is normally the case at this stage. The examiner of the course is positive about that we, the student counselors, have been responsible for the elements of personal development, since we were able to adapt the contents to the need of the students. Our experience is that the content should not be too theoretical or delivered too much as lectures. Students request tools, not lectures, on group psychology.

In interviews students indicate that they are interested in developing themselves personally to feel self-satisfaction and to be more secure about the decisions they must take, but also that they want more contact with professional life, more leadership and group dynamics, communication, presentation, rhetoric and feedback.

The teachers emphasize the importance of implementing measures that help increasing pass rates. They also see benefits of working more with students' motivation and setting goals, to create conditions for both students and teachers to focus on the subject matter in projects and theses instead of handling problems of inter-human character. Furthermore, many teachers have pointed out that the subject matter itself in technical courses causes personal development of the students – however, the students have been less clear about this. Maybe we will have learning outcomes related to personal development in ALL courses eventually, but of different kinds!

Representatives from various professional roles, industries and businesses, argue that they want engineers with good self-awareness who know how to communicate, who can understand and interpret other people's behavior, who know active methods of teamwork and

who can deal professionally with conflicts. They also call for skills in documentation, communication and presentation, commercial awareness, time management and attitude of ethics and values.

7. CONCLUSIONS

Our hypothesis is that an increased focus on the student's personal development can contribute to increased motivation, better learning and higher quality of teamwork in the engineering program. We have elaborated and suggested the EDIT model for how personal development could be realized. Further development of the model and its implementation into the curriculum and how the results could be assessed is however still in progress. Also the question of who should teach these elements is currently being discussed at Chalmers in parallel with an ongoing organizational change.

What distinguishes the ideas behind personal development from conventional courses in these programs is that we mainly target the process, i.e. how to interpret and process the lectured content and how it is allowed to influence opinion or behavior. We believe that reflection on what the student experiences, accelerates her personal-development process, increases motivation and contributes to improved quality. By working systematically with reflective questions such as “What skills have I developed so far? How do I know that? What are my goals for next semester? What do I do to reach my goals? For what reasons do I take this course? What do I want to achieve with this course? What do I need to take responsibility for?” the student develops faster.

During this year, the first three authors, the study counselors, have also been recognized and used as a resource for teachers and tutors who have had project teams that functioned poorly. On such occasions we have noticed that teachers often lack the means and tools to deal with problems occurring between students. As the number of courses with project elements tend to increase, we draw the conclusion that there will be an increased need for support for teachers and tutors, particularly as part of the students who need help to manage work in groups, often choose not to participate in the optional elements offered.

This year we have noticed more early dropouts from the programs than previous years. We have had fewer problems in teamwork and we have had more students who wanted to discuss whether the educational choices they have made are right for them or not. If the observed changes are coincidences or are due to the efforts we have made is too early to conclude. If these effects persist, one conclusion to be drawn is that no matter how and who will be responsible for implementation, the university must be prepared to support some of the students individually, as personal development will start processes within individual students’ minds.

The continued development and implementation depends on the interest of teachers, heads of educational programs, deans of education and administrative executives. The choice of teacher for personal development depends on if one chooses to develop the skills of student counselors or of the engineering faculty or possibly both. Either choice will require knowledge and establishment of a bond to the behavioral science field in order to achieve sufficient legitimacy.

We believe that an increased focus on the student's personal development will contribute to increased motivation, better learning and higher quality of teamwork in the engineering program, even though it is extremely hard to provide explicit evidence for this.

REFERENCES

[1] Chalmers tekniska högskola, Fas 1: Chalmers utbildningar inom EDITZ-området – Arbetsgruppens avslutande kommentarer, 2008, http://document.chalmers.se/doc/166548214, accessed on April 9, 2010, *(In Swedish).*

[2] Chalmers tekniska högskola, Fas 3: Slutrapport Omstart EDIT, 2009, http://document.chalmers.se/doc/1620286454, accessed on April 9, 2010, *(In Swedish)*.

[3] Biggs J., Teaching for Quality Learning at University, The Society for Research into Higher Education & Open Press University, 2nd ed. 2003.

[4] The CDIO Initiative, http://www.cdio.org/, accessed on April 9, 2011.

[5] Wiggins G., McTighe J., Understanding by Design, Prentice Hall, 2nd expanded ed. 2005.

[6] Borrego M., Cutler S., "Constructive Alignment of Interdisciplinary Graduate Curriculum in Engineering and Science: An Analysis of Successful IGERT Proposals", Journal of Engineering Education, Vol. 99, No 4, pp. 355-369, 2000.

[7] Aubrey B., Managing Your Aspirations: Developing Personal Enterprise in the Global Workplace, McGraw-Hill, 2010.

[8] Whitmore J., Coaching for Performance: Growing People, Performance and Purpose, 2002; Coaching: för bättre resultat, Brain Books 2003, *(Swedish edition).*

[9] Gjerde S., Coaching, 2003, *(In Norwegian)*; Coaching: vad, varför, hur, Studentlitteratur, 2004, *(Swedish edition).*

[10] Lennéer Axelson B. and Thylefors I., Om konflikter: hemma och på jobbet, Natur och Kultur, 1996. *(In Swedish)*

[11] Säljö R., Lärande i praktiken: ett sociokulturellt perspektiv, Norstedts Akademiska förlag, 2000. pp 65-73, *(In Swedish)*.

[12] Ryan M. R. and Deci E. L., "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well- Being", American Psychologist, Vol. 55 No.1, pp. 68-78, 2000.

[13] Pink, D., H., Drivkraft: den överraskande sanningen om vad som motiverar oss, Bookhouse 2010, *(Swedish edition).*

[14] Luft J. and Ingham H., The Johari Window, a graphic model for interpersonal awareness, Proceedings of the western training laboratory in group development. Los Angeles UCLA, 1955.

[15] Schutz W., The Human Element, 1994; Den goda organisationen: en modell för utveckling av människor, grupper och organisationer, Natur och Kultur, 1997, *(Swedish edition).*

[16] Ungdomsbarometern, Ungdomsbarometern AB, 2011, *(In Swedish).*

[17] Supplemental Instruction, Swedish website: http://www.si-mentor.lth.se/, accessed on April 9, 2011, The International Center for Supplemental Instruction: US website: http://www.umkc.edu/cad/si/, accessed on April 9, 2011.

[18] Chalmers University of Technology, Vision, goals and strategies 2008-2015 with outlook towards 2020, http://www.chalmers.se/en/about-chalmers/vision-goals-and-strategies/Pages/default.aspx, accessed on April 9, 2011.

[19] Swedish National Agency for Higher Education, The Higher Education Ordinance, Swedish Code of Statutes (1993:100), http://www.hsv.se/lawsandregulations/thehighereducationordinance.4.5161b99123700c42b07ffe3981.html, accessed on April 9, 2011.

[20] The Bologna process, The European Higher Education Area (EHEA), The Official Bologna Process website 2010-2012: http://www.ehea.info/, accessed on April 9, 2011.

[21] Chalmers University of Technology, "TEK245 - Appreciative leadership", course syllabus, https://www.student.chalmers.se/sp/course?course_id=14648, accessed on April 9, 2011.

[22] Chalmers University of Technology, "TEK075 – Work organization", course syllabus, https://www.student.chalmers.se/sp/course?course_id=14331, accessed on April 9, 2011.

[23] Chalmers University of Technology, "LSP310 – Communication and professional development", course syllabus, https://www.student.chalmers.se/sp/course?course_id=14379, accessed on April 9, 2011.

[24] Jönköping University, "LDCG10 – Dialogue, coaching and personal development", course syllabus, http://kursinfoweb.hj.se/syllabuses/LDCG10.html?semester=20112, accessed on April 9, 2011, *(In Swedish).*

[25] Umeå University, "Meritportfölj för programstudenter", course syllabus, http://www8.teknat.umu.se/epk/kursutbud/5TN009/5TN009.pdf, accessed on April 9, 2011, *(In Swedish).*

[26] Belbin M., Teamroller i praktiken, IHM förlag 2004, *(Swedish edition).*

[27] The Belbin Team Roles, Swedish website: http://www.belbin.se/, accessed on April 2011, International website: http://www.belbin.com/, accessed on April 9, 2011.

Acknowledgements
The work reported on in this paper has been performed jointly among EDIT programs; the authors would therefore like to thank their colleagues: Wolfgang Arendt, Head of the 5-year SE program; Patrik Jansson, Head of the 5-year CE program; Samuel Bengmark, former Head of the 5-year SE program and Peter Lundin, former Head of the 5-year CE program, for contributing to this project and for being members of the steering group. Also, contributions from the teachers, students, members of the reference group, Chalmers Careers Service, Chalmers Learning Centre, Leif-Åke Fröjelin and other involved persons are greatly acknowledged.

Biographical Information
Marie Bernelo graduated from School of Social Work, University of Gothenburg in 1981. She is educated in psychology, diversity and human resources and has worked as a business developer, internal consultant and with human-resource management. She holds an ICF Coach Diploma and works as a student counselor at Chalmers, with the MSc program in Electrical Engineering since 1987. She also heads the Supplemental Instruction activities at Chalmers.

Sofia Honsberg graduated from School of Social Work, University of Gothenburg in 1992. She has studied occupational and organizational psychology and holds a first-level diploma in psychodynamic therapy. She holds an ICF Coach Diploma and works as a student counselor at Chalmers since 2001 and with the MSc program in Computer Engineering since 2006. For many years, she has worked as a sports instructor and as a trainer of other instructors.

Anette Järelöw holds a degree in Behavioral Science from the University of Gothenburg, where she also has conducted studies in Media and Communication and Education. She holds an ICF Coach Diploma and works as a student counselor at the MSc program in Software Engineering at Chalmers since 2000. She is the course manager for the course Professional development for engineers and coordinator of the mentoring program MEDIT.

Jörgen Blennow is an associate professor in High Voltage Engineering at the department of Materials and Manufacturing Technology and the Head of the 5-year program in Electrical Engineering at Chalmers University of Technology, Gothenburg, Sweden. He participated in the project as a member of the steering group. His research focus is related to electrical insulation.

Lena Peterson is an associate professor at the department of Computer Science and Engineering and a Dean of Education for the EDIT-I education area at Chalmers University of Technology, Gothenburg, Sweden. She participated in the project as a member of the steering group. Her research focuses on design methodologies for analog circuits.

Corresponding author
Dr. Jörgen Blennow
High Voltage Engineering
Dept. of Material and Manufacturing Technology
Chalmers University of Technology
SE - 412 96 Gothenburg, Sweden
+46 31 772 1625
jorgen.blennow@chalmers.se